

REMARKS**Rejections Under 35 USC 103**

The Office Action rejects claims 18, 20-24, 52 and 56-58 as being obvious over U.S. Patent No. 6,306,554 of Barclay.

Claim 18, as amended, recites a photoresist having a micron or submicron linewidth variation when exposed to radiation having a wavelength of about 248 nm or less, which comprises a polycyclic copolymer, a photoacid generator and a base having a molar concentration ratio in a range of *about 0.2 to less than 1* relative to the photoacid generator.

The Examiner repeats her assertions that Barclay teaches a base to PAG molar ratio in a range of 0.2 to 20, which overlaps the claimed range. As discussed in detail in the response to the previous Office Action, Applicant respectfully maintains that the Examiner employs Applicant's own teachings to extract the broad range of 0.2 to 20 for the base to PAG molar ratio from the Barclay reference. Further, even if one assumes that Barclay teaches a broad range of 0.2 to 20 for the base to PAG molar ratio, the narrower range of 0.2 to less than 1, recited in amended claim 1, provides unexpectedly better results for the line edge roughness (LER) (i.e., much lower LER), as corroborated by experimental evidence presented in a previously-filed affidavit and an affidavit filed with the present response.

In this Office Action, the Examiner asserts that the experimental results were not sufficiently persuasive because the closest data point beyond the upper end of the claimed range was too far away from that end. In response, Applicant files another affidavit with this response in which experimental data is presented indicating that photoresist compositions having base to PAG molar ratios are in a range of 1 to 1.5 are not capable of functioning as positive photoresists. As discussed below, the additional experimental data in conjunction with the previously-presented experimental data, together with amending claim 1 as noted above to recite a base to PAG molar ratio in a range of about 0.2 to *less than 1*, are believed to be sufficient to establish that claim 1 distinguishes patentably over the cited art.

Before discussing the new affidavit, Applicant notes that in the affidavit presented with the previous response, LER data points corresponding to base to PAG ratios of 0.321, 0.481, 0.642, and 0.802 (all of which lie within the claimed range) were presented, at each of which a low LER was observed. In addition, the previous affidavit provided experimental results for a composition having a base to PAG molar ratio of 0.160 (below the lower end), which exhibited a much greater LER, as well as for compositions having base to PAG molar ratios of 2, 5, 10, 15 and 20 (all above the upper end) that simply failed to image. In addition, the experimental data provided within the specification indicate that other base to PAG molar ratios within the claimed range similarly provide unexpectedly good (low) line edge roughness. For example, a composition designated as Resist 99109 in Example 5 in the specification having a base to PAG molar ratio of 0.889 (about 0.9) provides a low LER.

In the present affidavit, Applicant provides additional experimental data for seven compositions having the following base to PAG molar concentration ratios: 0.8, 0.9, 1, 1.1, 1.2, 1.3, 1.4 and 1.5. Although no quantitative measurement of LER was performed for the compositions having base to PAG molar ratios of 0.8 and 0.9 (such LER data is presented in the previous affidavit and within the specification as noted above), these two compositions showed sufficient sensitivity, high contrast and acceptable UFTL (unexposed film thickness loss) to function as suitable photoresists at 157 nm wavelength. In contrast, for each of the compositions having a base to PAG molar ratio equal or greater than 1, even at a high exposure dose of 50 mJ/cm², some resist film remained on a wafer on which the film was coated. In other words, none of these compositions was suitable for functioning as a viable photoresist at 157 nm at lithographical useful sensitivities.

Accordingly, applicant has now provided a number of data points both within and without the claimed range that show that compositions having base to PAG molar ratios within the claimed range not only can function as photoresists at 157 nm but also exhibit much lower LER, whereas the compositions having base to PAG molar ratios outside the claimed range either show much larger LER or simply fail to image.

Accordingly, claim 18, and claims 52 and 56-58 that depend either directly or indirectly on claim 18, distinguish patentably over Barclay.

Independent claim 20 recites a photoresist having micron or submicron linewidth variation when exposed to radiation having a wavelength of about 248 nm or less, which comprises a cycloolefin based polymer or copolymer, a photoacid generator and a base having a molar concentration in a range of about *0.2 to less than 1* relative to the photoacid generator.

The arguments presented above apply to establish that claim 20 is also patentable over Barclay. In particular, similar to claim 18, claim 20 recites that the PAG to base molar ratio is in a range of about 0.2 to less than 1. Further, claims 21-24 depend on claim 20, and hence are also patentable.

In Paragraph 3, the Office Action rejects claims 18, 20, 21, 23, 24, 52, and 56-58 as being obvious over the combined teachings of Barclay and U.S. Patent No. 5,879,856 of Thackeray.

As discussed above, claim 18 distinguishes patentably over Barclay because Barclay fails to recognize that a photoresist composition having a base to PAG molar ratio in a range of about 0.2 to less than 1 can exhibit much reduced line edge roughness. Thackeray does not cure the shortcomings of Barclay in this regard. Even if one agrees with the Examiner that Thackeray teaches a photospeed to PAG molar ratio in a range of 0.0212 to 0.42, it does not recognize that a small subset of this range, namely, 0.2 to 0.4, and values beyond this range up to 1 can result in much reduced line edge roughness. In other words, neither Barclay nor Thackeray teaches or suggests the claimed range of about 0.2 to less than 1 recited for the base to PAG molar ratio in claim 18.

Thus, claim 18, and claims 52 and 56-58 that depend on claim 18, are patentable over the combined teachings of Barclay and Thackeray.

Similar arguments apply to establish that independent claim 20, and claims 21, 23 and 24 that depend on claim 20, are patentable over Barclay and Thackeray. In particular, similar to claim 18, claim 20 recites a molar concentration ratio in a range of about 0.2 to less than 1 for the base relative to the photoacid generator – a range not taught by Barclay or Thackeray.

In Paragraph 4, the Office Action rejects claims 25-28 and 59 as being unpatentable over Barclay in view of Published International Application No. WO 00/67072 of Feiring.

Claim 25, as amended, recites a photoresist having micron or submicron linewidth variation when exposed to a wavelength of about 248 nm or less that includes a polymer or copolymer containing fluorinated alcohol substituted polycyclic ethylinically unsaturated monomeric unit, a photoacid generator and a base having a molar concentration ratio in a range of *about 0.2 to less than 1* relative to the photoacid generator.

As discussed in detail above, Barclay fails to teach that utilizing a base to PAG molar ratio in a range of about 0.2 to less than 1 would result in much reduced line edge roughness. Further, Feiring, which relates to fluorine containing polymer compositions having UV transparency, does not teach this range of base to PAG molar ratios.

Accordingly, claim 25, and claims 26-28 and 59 that depend on it, are patentable.

In Paragraph 5, the Office Action rejects claims 25, 26, 28 and 59 as being obvious in view of the combined teachings of Barclay, Thackeray and Feiring.

As discussed in detail above, the combined teachings of Barclay and Thackeray fail to teach or suggest the range of base to PAG molar ratio recited in amended claim 25 (i.e., a range of about 0.2 to less than 1). Further, Feiring does not bridge the gap in the teachings of Barclay and Thackeray as it does not teach a base to PAG molar ratios in this range. Accordingly, amended claim 25, and claims 26, 28 and 59 that depend on claim 25, are patentable over the combined teachings of these references.

New Claims

New claim 60 depends on claim 18, and further recites a narrower range of about 0.2 to about 0.9 for the molar concentration ratio of the base relative to the photoacid generator. New claim 61 depends on allowed claim 19, and further recites a narrower range (from about 0.2 to less than 1) for the base to PAG molar ratio than that recited in claim 19. Support for claims 60

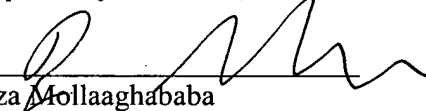
and 61 can be found in the original claims, and throughout the remainder of the specification. Claim 19 is allowed, and hence so is dependent claim 61. Further, claim 18 is believed to be in condition for allowance, as discussed in detail above. Hence, claim 60 that depend on claim 18 is also in condition for allowance.

CONCLUSION

In view of the above amendments and remarks, Applicant respectfully requests reconsideration and allowance of the application. If there are any remaining issues, the Examiner is invited to call the undersigned at (617-439-2514) to expedite the prosecution of the present application.

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Respectfully submitted,

By 

Reza Mollaaghababa

Registration No.: 43,810

NOTTER MCCLENNEN & FISH LLP

World Trade Center West

155 Seaport Boulevard

Boston, Massachusetts 02210-2604

(617) 439-2000

(617) 310-9000 (Fax)

Attorney for Applicant